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Efficiency Evaluation of European Financial Cooperative Sector. A Data Envelopment Analysis Approach

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Abstract *The co-operative banking sector has become a major force in the socio-economic development of the European continent's and is increasingly becoming an important part of the continents banking sector. By applying the Data Envelopment Analysis (DEA) approach, this paper evaluates the efficiency of co-operative banks from some selected European countries during a period of 2008–2013. The results of our estimation show that overall efficiency of the co-operative banks in our sample is high. Our efficiency results also show that the European cooperative banking sector is both efficient and stable over the period under review. Our results lend credence to the resilience theory of the co-operative banking business model. During the period of the Great Financial Crisis, the sector holds firm showing little or no variation in efficiency level.*

Key words Financial co-operatives, productive efficiency, technical efficiency, allocative efficiency, Bank efficiency, Non-parametric frontiers, financial crisis

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1. Introduction

Efficiency and the effective utilization of resources have been key factors for the survival of banks and have been paramount objectives of every bank managers regardless the type, nature and size of banking institution they manage. Bank managers are very concerned with putting their limited resources into a more productive use particularly in this period where resources at their disposal are limited and shareholders demand more of corporate profit is on the rise. Graff and Karmann (2006) argue that banks must allocate their scarce resources in an efficient manner during the production of their products and services. The subject of efficiency maximization has become increasingly important in banking as a result of recent developments in the global and financial landscapes. Fierce competition in banking sectors brought about by globalisation, technological advancement, and deregulation in the banking sector and the recent waves of mergers and acquisitions in the financial industry. The recent financial crisis has contributed significantly to the burden of efficiency management by bank managers (See Barra Cristian *et al.* (2013), Popovici (2014)).

Regulators and policymakers have both awash the banking sector with regulations which have significantly increased bank costs. The costs of meeting these requirements have negative implications for banking efficiency (Pasiouras *et al* (2009). In a separate study, Chortareas *et al.* (2010) find evidence to support the claim that regulatory policies such as capital requirements and other supervisory powers that impose restrictions on bank activities reduce banks operation efficiency. The going-concern of banks has become so much dependent on the level of its efficiency; investors now consider efficiency ratios or parameters as important yardsticks for determining banks investability. The questions of how effectively a bank utilises its assets or manages its liabilities become a key factor in his investment decision making.

The measurement of economic efficiency in firms can be traced to the works carried out by Koopmans (1951) and Debreu (1951)[1] and later the seminal study by Farrell (1957). In his paper titled *"The Measurement of Productive Efficiency"*, Farrell (1957), influenced by the studies carried out be Koopmans

[1]Koopmans (1951) provided the definition of *technical efficiency* while Debreu (1951) carried out the first measurement of productive efficiency with his work titled: *The coefficient of resource utilization*.

and Debreu, specified two components of production efficiency: *Technical efficiency* and *Allocative efficiency*.

Since the creation of the Co-operative movement in Europe in the 19th century, Co-operative banks have become both a financial and an economic powerhouse in the European continent. Creating and adding values by providing grass root finance to millions of their owners and customers. Today, co-operative banks are ubiquitous on the continent with 4,200 Co-operative banks with more than 68, 000 outlets, owned by 78 million members and servicing more than 205 million customers. The Co-operative banking sector currently employs more than 860, 000 people, contributing immensely to the employment growth in their various local communities[2]. Co-operative banks help contribute to the financial stability of the continent by maintaining proximity to the millions of customers they were created to serve. According to the EACB,[3] the Co-operative banks contribute significantly to the financing of the real economy, particularly to the households and the Small and Medium Enterprise (SME). In countries such as Italy, France, Germany and the Netherlands, the market share of loans ranges between 25 percent and 45 percent.[4] Like any other banking type, efficiency has become one of the key objectives that Co-operative banks must achieve if they are to remain in business particularly at a time where the competition with the commercial banks is fierce. Opinions differ in the literature the literature on the level of efficiencies in Co-operative banks compared to the commercial banks (See for example, Girardone *et al.*, 2009; Altunbas *et al.*, 2003).

This paper applies the non-parametric frontier method of the data envelopment analysis approach to evaluate performance and efficiency in co-operatives banks from selected European countries. Researchers have investigated of efficiencies in the European banking industry (See, for example Bikker 1999; Nenovski *et al* 2008; Vivas 1997; and Barra *et al.,* 2013). In our best knowledge, a multi-country study of European Co-operative banking sector is rare. Giving the strategic role of the co-operative banking sector in Europe and its contribution to the growth and development of the European economy, we believe that the limited attention giving to the sector is inadequate. We also believe that the impact of the recent financial crisis on the efficiency of the co-operative banking sector has not been fully analysed.

2. Literature Review

2.1. Co-operative Banking Efficiency

Some research has been carried out to study different areas of efficiency in banking and other financial institutions. Berger and Humphrey (1997) categorised efficiency studies on banking and other financial firms into three distinct classes. (1) Efficiency studies that emanate from government policies on issues such as deregulation, mergers, market and bank failures (Janoudi 2014; Lee and Chih 2013; Agoraki *et al.* 2011; Ayadi *et al.* 2005). (2) Studies on industry efficiency, firm performance, firm ranking and comparisons. (3) Studies on managerial performance carried out with a view to improving managerial performance by identifying the right strategy and process (see, Halkos and Salamouris 2004). These studies have employed both parametric and non-parametric methods to model efficiencies in banking. Two of the most important non-parametric methods used are the Stochastic Frontier Analysis (SFA) and the data envelopment analysis (DEA) approach. There is, however, a paucity of literature on the study of efficiency and performance evaluation of European Co-operative banking sector. The majority of studies on bank efficiency are concentrated on commercial banks (Daley and Mathews 2009; Halkos and Salamouris 2004; Almumani, 2013) and mostly in the United States Banking Sector (see for example, Mester 1996; Devaney and Weber 2000; Irsová and Havránek 2010; Hughes and Mester 2008; Berger and Mester 2003; Fung 2006).

Given the above, we now review some of the available literature on the efficiency of co-operative banks. In their seminal paper, titled Bank *Ownership and Efficiency*, Altunbas *et al*. (2001) use multiple approaches to model cost and profit and technical efficiency in different types of bank in the German

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[2] Source: http://www.eacb.coop/en/cooperative_banks/characteristics.html
[3] EACB: European Association of Co-operative Banks
[4] According to EACB, SMEs represent between 20% and 50% of the total client portfolio of Co-operative banks in Italy, France, Germany and the Netherlands.

banking sector. They did not find any significant evidence to suggest that privately owned banks are more efficient than mutual (co-operative) banks and publicly owned bank. They find, however, that mutual (co-operative) banks and government-owned banks are slightly better than private banks in with respect to cost and profit efficiencies. Schiniotakis (2012) used multiple regression analysis to determine the factors that influence the profitability of commercial and co-operative banks; He finds evidence to suggest that the type of bank is an important factor in determining the level of profitability. He also finds that only well-capitalised banks with sufficient liquidity and cost efficiency have Return on Assets (ROA). The paper finds that co-operative banks were less affected by the financial crisis compared to the commercial banks. Other studies that investigate cost and profit efficiency in Co-operative banks include Worthington (1998).

Pasiouras *et al.* (2007) employs data envelopment analysis (DEA) modelling approach and Tobit regression to estimate the cost efficiency of Greek Co-operative banks. They use the data envelopment analysis (DEA) to measure the technical, allocative and cost efficiency. They find that Co-operative banks in their sample could improve their cost efficiency by 17.7% on average. They also find evidence to suggest that allocative rather than technical efficiency is the overriding determinant of cost inefficiency. Using Tobit regression to estimate the effect of external and internal factors on Co-operative banks efficiency, they find evidence to indicate that bank size has a positive impact on banks efficiency. In a separate study Francesco and Graziella (2013) concludes that Co-operative banks have better performance than other banking types. Other literature, which investigate Co-operative cost efficiency include (Shen and Chen 2008; Subhass and Abhiman 2010; Resti 1997).

The recent financial crisis has had a significant impact on the efficiency of the global financial system and the banking sector. For example, Vu and Turnell (2011) used a stochastic frontier analysis to investigate the impact of the recent global financial crisis on Australian banks. They find evidence to suggest that the crisis had adverse effects on the profit efficiency of Australian banks. They, however, did not find evidence to show that the crisis had any significant impact on cost efficiency. The financial crisis had a significant impact on the efficiency of the Co-operative banking sector (see,). Bara *et al.* (2013) analysed the impact of the recent financial crisis on Italian small banks; they find that the financial crisis has a negative effect particularly on co-operative banks. However, (Boonstra 2010, Groenveld 2011) do not find significant evidence to suggest that the Crisis had any significant impact on the efficiency of Co-operative banks. A common argument for those studies that do not find any significant impact of the crisis on the efficiency of Co-operative banks is that Co-operative banks exposure to the subprime mortgage lending is insignificant

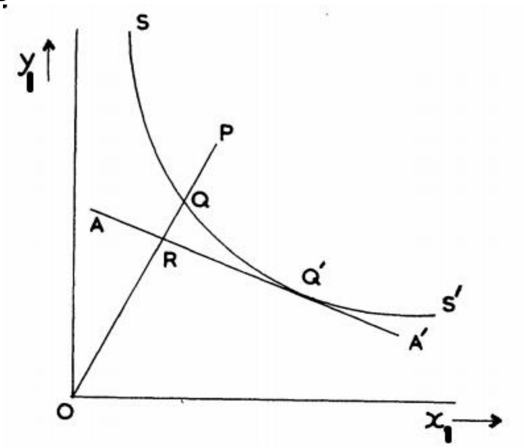
Unlike the commercial banks that grant loans to wide range customers, Co-operative banks are characterised by granting loans mainly to their stakeholders. The substantial parts of their income are generated from the interest charged on the loans. The performance of the loans granted has been a subject of academic study for many years. (Barros *et al*., 2012; Colin *et al*., 2013) investigate the relative performance of cooperative banks in Japan by modelling non-performance loans. Their empirical result shows three main findings: Firstly, they find evidence to suggest that the Japanese co-operative banking sector showed increasing returns to scale. Secondly, they find that the banks have shown considerable technical progress with a decrease in technical efficiency. Lastly, their study indicates that the regulatory pressure to shed their non-performing assets will have a negative effect on the output and performance of the banks. We argue that regulatory pressure on co-operative banks to lower risk lending will have an impact on their profit efficiency.

There have been studies on other areas of interest on Co-operative banks, for example, Deelchand and Padgett (2009) investigated the relationship between size and scale economies in Japanese Co-operative banks. Fiordelisi and Mare (2013) study the contribution of efficiency to the measurement of the probability of default of co-operative banks. They find that the level of efficiency is both positive and statistically significant to the probability of survival of co-operative banks.

3. Methodology of research

Building on the studies advanced by Koopmans (1951) and Debreu (1951), Farrell (1957), laid the foundation for the study of efficient frontier. Where he showed that a firm efficiency measure can be computed using multiple inputs. He proposed that the total or economic efficiency of any firm is a function of its *technical* and *allocative* efficiency. He defines *technical efficiency* as the efficiency achieved by a firm when it can produce maximum output from a given set of inputs. On the other hand, *allocative efficiency,* which Farrell termed "price "efficiency is achieved when a firm achieves optimal production of goods and services. That is the output level at which price equals the Marginal Cost of production.

Farrell (1957) based his explanation of efficiency measure on a simple analogy of a firm uses two inputs, W_1 and W_2 to produce a single output *Z*. Under the assumption that the production function to be measured exhibit a constant return to scale (i.e., a condition of linear homogeneity). A firm technical efficiency of the production can be observed above the *unit isoquant.* A general presentation of Farrell's efficiency frontier is shown in figure 1.



Modified from Farrell (1957)

Figure 1.

Point *P* represents the quantity of W_1 and W_2 employed by a given firm to produce a unit of *Z.* While the isoquant curve SS^I shows all possible combinations of, W_1 and W_2 that might lead to the production of *Z* by a perfectly efficient firm. According to Farrell (1957), the input-per-unit-of-output ratio, *OQ/OP* defines the most efficient use (i.e., the technical efficiency of the firm) of W_1 and W_2 to produce a unit of *Z.* Point Q is considered to be technically efficient since it lies on the isoquant SS^I**.** Any deviation of the input-per-unit-of-output ratio from isoquant SS^I was deemed to be *technical inefficient*.

To estimate the relationship between a firm's usage of its production inputs and their prices, Point AA^I in Figure 1 represents the ratio of the input prices at point *P* is equal to a fraction of *OR/OQ,* where RQ represent the cost saving due to a reduction in the quantity of inputs. If production occurred at Q^I *this is* the *allocative efficient*[5] and *technically efficient* point of the firm and not at *Q* – which is the *technically efficient* but *price inefficient* point on the efficient isoquant. For a perfectly efficient firm, both *technical* and *allocative efficiency* would be equal to a fraction of *OR/OP*. Farrell (1957) concludes that the overall measure of the efficiency of a firm, therefore, is the product of the technical and price (allocative) efficiencies.

Following Farrell (1957) suggestion that the efficient unit isoquant can be measured by programing methods, there have been a number of techniques available in the literature for the measure of the efficiency. Each estimation technique is characterised according to model parameters and assumptions used to construct the efficient frontier. Studies on the efficiency and performance of firms in the financial industry have employed largely both non-parametric and parametric frontier analysis (see for example; Pastor et al 1995; Fiorentino *et al.* 2006; Doumpos and Zopounidis 2012; Repkova 2014). In this paper, we would apply data envelopment approach (DEA) approach, a non-parametric analysis to estimate the efficiency and performance of European co-operative and saving banks.

3.1. Data Envelopment Analysis Model

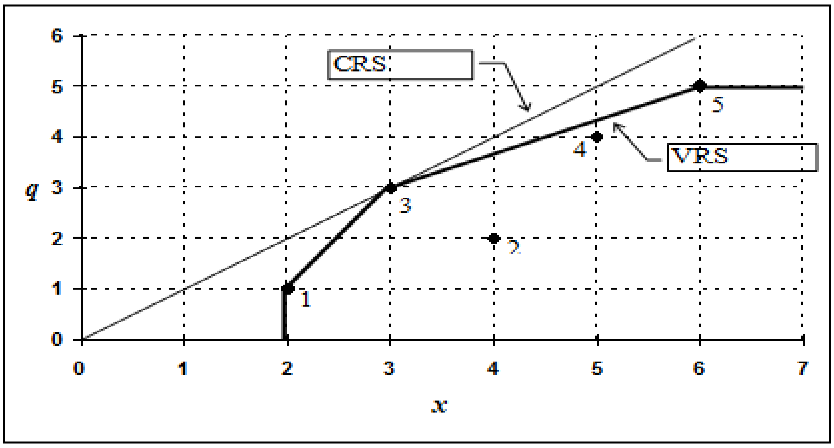
Building on the work of Farrell (1957), Charnes, Cooper and Rhodes (CCR) (1978) developed the data envelopment analysis (DEA) model. A "data oriented" approach that can be used to evaluate the efficiency of "decision making units" (DMU's) using a general inputs and outputs. Data envelopment analysis, a non-

[5] Farrell (1957) refers to allocative efficiency as price efficiency

parametric technique is a linear programming approach to envelop observed input - output vectors in a closed mode (Boussofianne *et al.,* 1991). As a frontier efficiency approach, the basic logic behind DEA estimation involves the determination of the decision-making -units (DMU) which lie on the frontier followed by the computation of other DMUs relative to the frontier.

The DEA approach has been used extensively to estimate the production functions in a wide range of industries (see for example, Cooper *et al* 2000; Walden and Kirkley 200; Francesco 2009), and in particularly the financial industry. DEA has been used widely to estimate efficiency functions in banking. For example, the approach has been used to measure the technical efficiency in banking (Fukuyama 1993; Ferrier et al, 1994; Kumar and Gulati 2008; Gokgoz 2014), Operational efficiency (Golany and Storbeck 1999; Lu *et al*. 2007), bank performance and profitability efficiency (Eken and Kale 2011; Loukoianova 2008) and estimation of cost efficiency (Fiorentino *et al*., 2006; Vu and Turnell 2011).

DEA approaches can be categorised in terms of the scale assumptions behind the model. Two commonly use scale assumptions are the constant returns to scale (CRS) and the variable returns to scale (VRS). Charnes, Cooper, and Rhodes (1978) proposed an input orientation with a constant return to scale. CRS model entails all DMUs to be operating at their optimal scale, that is, a change in outputs is directly proportional to the changes in inputs. For example, if the inputs are doubled, the outputs are also doubled. The VRS on the other hand is introduced by Banker, Charnes, and Cooper (1984). In the VRS, the units of outputs produced may show increasing, constant and decreasing proportion than the increase in the units of inputs. Consider Figure 2 below, where points 1, 2, 3 and 4 denote the efficiency frontier under both CRS and VRS scale assumptions.



Source: Modified from Coelli (1996)

Figure 2. CRS vs. VRS frontiers

With constant return to scale (CRS), point 3 represents the efficiency frontier while points 1, 4 and 5 which drift away from the frontier are the inefficient frontiers. While points 1, 4 and 5 are considered the efficient frontiers in the VRS model and point 3 as inefficient showing underutilisation of inputs.

Following the development of an operational DEA model by Charnes, Cooper, and Rhodes (1978). A number of other linear -programmed DEA models have been developed to estimate efficiency levels of DMUs from either an input or output orientation, or from models that permit both input and output orientation to measure changes in input and output level concurrently – that is, synchronizing decrease in input and increase in output. The input- orientation DEA models determines the amount of the input from a DMU that could be reduced to efficiently produce a specified output level. On the other hand, the output-oriented DEA models are programmed to determine the amount of a DMU's output that can be obtained from a given input levels.

DEA Mathematical Formulation – CCR Model

Charnes, Cooper, and Rhodes (1978) introduce the first operational DEA model (CCR Model) to measure the efficiency of firms or DMUs using specified inputs and outputs. The CCR model employs a linear programming method to calculate the efficiency of a DMU. The model measures a relative rather than an absolute efficiency of a unit by computing the efficiency of each DMU and compares the result with those of other DMUs. Efficiency of any DMU is calculated as the maximum of a ratio of weighted outputs to a weighted inputs subject to the condition that ratios calculated for each DMU is less than or equal to one (unity).

Let x_{ij} – represent the observed input *i* for DMU_j $(x_{ij} > 0, I = 1, 2, \ldots m, j = 1, 2, \ldots, n)$ and y_{rj} is the observed output *r* for DMU_j $(y_{rj} > 0, r = 1, 2, \ldots, s, j = 1, 2, \ldots, n)$. Then the relative efficiency measure h_0 for the selected DMU_o can be estimated by solving the mathematical programming of the primal CCR model proposed by Charnes, Cooper, and Rhodes (1978) expressed as follows:

$$\max h_0 = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}}$$
$$subject \quad to:$$
$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \le 1;\ j = 1,2,\ldots,n,$$
$$u_r, v_i \ge 0;\ r = 1,2,\ldots,s;\ i = 1,2,\ldots,m \qquad (1)$$

$$\max_u z_0 = \sum_{r=1}^{s} u_r y_{r0}$$
subject to
$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0,\ j = 1,2,\ldots,n$$
$$\sum_{i=1}^{m} v_i x_{i0} = 1$$
$$u_r \ge 0, r = 1,2,\ldots,s$$
$$v_i \ge 0, i = 1,2,\ldots,m. \qquad (2)$$

Where: *m* and *s* are the quantity of inputs and outputs used respectively; u_r and v_i are the weights to be estimated for output *r,* and input *i* respectively. *n* represents the number of units and h_k *is the relative efficiency of* DMU $_0$.

Equation (1) above is a nonlinear fractional programming, which may lead to an uncontrollable mathematical computation involving a large number of DMU_0 (*n*) and small quantity of inputs (m) and outputs (s). To resolve this problem, Charnes, Cooper, and Rhodes (1978) reduced the ratio model form to an equivalent linear programming form. The resulting linear programming for DMU_0 is given as follows:

Equation (2) above is an ordinary or multiplier linear programming problem which has a duality linear programming form. The linear programming dual for DMU $_0$ is given as follows:

$$\min_\lambda z_0 = \theta_0$$
$$subject \quad to$$
$$\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{r0}, \quad r = 1,2,\ldots,s$$
$$\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta_0 x_{io}, \quad i = 1,2,\ldots,m$$
$$\lambda_j \ge 0, \quad j = 1,2,\ldots,n \qquad (3)$$

Equation (3) above is known as the envelopment for of the DEA approach.

Strengths and Weaknesses of DEA Model

DEA provides complete information on the performance of a firm and has become a useful and a powerful tool for researchers due to its unique strengths at measuring different types of efficiencies in various industries. The ability of DEA to utilise multiple inputs and multiple output models make it possible to measure the performances of many decision making units at the same time. The model allows like for like comparison, as DMUs are directly benchmarked against peers or a group of peers even when inputs are stated in different measuring units Charnes *et al.* (1994). Despite the advantages that DEA brings to bear in the efficiency measurement, it is not without shortcomings. Like any other empirical model, DEA configuration is based on a number of assumptions that must be taking into consideration when interpreting the results based on the technique. The model has been criticized in some literatures on both operational and functional grounds (see for example, Evans and Heckman, 1988; Frank 1988; Schmidt 1986). Among others, some of the limitations of the model include: (i) DEA being a non-parametric technique, it is difficult to perform statistical hypothesis tests. (ii) DEA model formulates a discrete linear programming for each DMU; estimation involving a large number of DMUs may be computationally intractable. (iii) While DEA model is a good "relative" efficiency measure, it is a poor measure of "absolute" efficiency.

4. Data and Variables

The data used for this study is obtained directly from the individual bank's financial and annual reports available on the banks website during the period of 2004 – 2013. Data on British building societies is obtained from the British building societies association data base. The BSA collects and analyses the financial figures for their members. The co-operative banks evaluated in this study originate from different European countries including Germany, Netherlands, Italy, Spain, the United Kingdom, France, Austria, Denmark and United Kingdom, Finland and Portugal. In all of these countries, financial co-operatives of various models have long been established and constitute a significant part of their banking sectors. In the United Kingdom, data from both the co-operative bank and Building societies are included in the analysis.

4.1. Selection of Efficiency Variables

In banking efficiency literature, different approaches have been used to define the input and output variables. This is because there are different interpretations of what constitute an input and output factors of production for banks. Two most common approaches that have gained prominence in existing literature are the intermediation and the production approaches. The proponents of the intermediation approach consider a banking institution as a financial intermediary (see, for example, Sealey and Lindley, 1977). That uses a combination of deposit liabilities, capital and labour at their disposal as inputs to produce risk assets and investments. While the production approach (also known as the value-added approach), maintained that a bank is more or less a service entity that uses the deposits and loans at its disposal to provide other services for his customers (see, Sherman and Gold, 1985; Berger and Humphrey 1997).

In this study, we adopted the intermediation approach to define co-operative banks input and output variables. In line with this approach, we assume that co-operative banks like any other banking types are financial intermediaries that transform deposit liabilities to risk assets. We also assume that in discharging their financial intermediary role, banks use the services of their employees (labour). Following this assumptions, we define two input variables and one output variable as follows: input variable (Total deposits (X1), Labour (X2)) and Output variable (Total Earning Assets (Y1)).

We measured deposits as total deposits from customers **(TOTAL DEPOSIT),** Labour is measured as numbers of employees in full-time equivalent **(LABOUR).** For output variable, we define Loans as total loans to customers (**TOTAL EARNING ASSETS**). Descriptive statistics of input and output variable is presented in Table 1.

Table 1. Descriptive statistics of input and output variables (in Euro million)

	Total Deposits	Labour	Total Earning Assets
Mean	186744.76	40891.08	192218.80
Median	92167.50	17355.50	88705
Mode	139356	32000	95589
Standard Deviation	235849.22	56506.65	244590.64
Minimum	9613	920	7734.78
Maximum	833000	191243	929800

5. Efficiency Analysis Results

We evaluated the efficiency of financial cooperatives, including co-operative banks and building societies from selected European countries for a period between 2008 and 2013. To analyse the overall efficiency of the decision making units (DMUs) in our sample, we employ the data envelopment analysis (DEA) approach. Using the input-oriented DEA approach, both constant return to scale (CRS) and variable return to scale (VRS) models are estimated on a panel data of 15 financial cooperatives. Table 2 summarizes the efficiency results of banks in our sample by year.

Table 2. Average efficiency of selected European financial co-operatives by year

Year	CRS	Inefficiency	VRS	Inefficiency
2008	0.8006	0.1994	0.9087	0.0913
2009	0.7682	0.2318	0.8586	0.1414
2010	0.7880	0.2120	0.8806	0.1194
2011	0.7915	0.2085	0.8706	0.1294
2012	0.7785	0.2215	0.8730	0.1270
2013	0.7773	0.2227	0.8760	0.1240

Source: Author's calculations

With respect to the dynamics of the efficiency results, the efficiency scores do not show any significant changes over the period being analysed. The calculated efficiency scores under CRS (DEA) and VRS (DEA) models vary from 77% to 80% and 86% to 91% respectively. On the other hand, the average inefficiency scores calculated under the CRS (DEA) and VRS (DEA) models are 22% and 12% respectively. The efficiency scores of the VRS (DEA) model show a significant improvement in each year under consideration over the CRS (DEA) scores.

This results of our analysis for both models show that the European cooperative banking sector was efficient during the period under review. Years 2008 and 2009 marked the peak of the great financial Crisis. The average efficiency scores under the CRS (DEA) and VRS (DEA) models during 2008 -2009 were 78.4% and 88.4% respectively. This confirms that the efficiency and the stability of the sector were not significantly affected by the financial crisis. The results give further credence to the resilience theory of the co-operative business models. The fairly high inefficiency (CRS, 23%) in 2009 could be attributed to the general lull in macroeconomic activities due to the impact of the crisis and possibly managerial inefficiencies (see Bos and Kool, 2006).

Table 3. Efficiency of Selected European Financial Co-operatives by country

Country	**Technical Efficiency Score (CRS)**	**Pure Technical Efficiency Score (VRS)**	**Scale Efficiency Score**
Germany	0.6637	0.7908	0.8392
France	0.7958	0.9269	0.8586
Portugal	0.5957	1.0000	0.5957
Italy	0.6699	0.6793	0.9862
Finland	0.9208	0.9651	0.9541
Austria	0.8171	0.8217	0.9944
Netherlands	1.0000	1.0000	1.0000
United Kingdom	0.6337	0.7532	0.8413
Spain	0.7083	0.7280	0.9730
United Kingdom**	0.8319	0.9194	0.9048

**Building Societies
Source: Author's calculations

Table 3 presented the technical efficiency, pure technical efficiency and the scale efficiency scores of financial co-operatives by country of origin. Co-operative bank from the Netherland achieved maximum efficiency of 100% under both the CRS (DEA) and VRS (DEA). On the other hand, the bank from Portugal has the lowest efficiency under the CRS (DEA) model, but achieved a 100% pure technical efficiency score under the VRS (DEA) model. The dip in technical efficiency for the sector in Portugal can be explained by the harsher effects of the financial crisis on the country and the aggressive competition from commercial banks. That makes it difficult for the sector to attract deposits from customers. It is worth mentioning, in general, that the scale efficiency score for the financial co-operative sector in each country, with the exception of Portugal, remains very high.

6. Conclusions

The main aim of this study is to provide a comparative efficiency analysis of financial cop-operative banks in some selected European countries where the presence of the co-operative business model is very high. We estimated the efficiency of the financial co-operative institutions in the sample by applying Data Envelopment Analysis (DEA) approach on recent data available starting from 2008 – 2013. The choice of the period for the study is to enable us analyse the effect of the Great Financial Crisis on the European co-operative banking sector as a whole. The result shows that the overall efficiency of co-operative banks in our sample is high; the banks from the Netherlands achieved the highest possible level of efficiency during 2008 – 2013. Banks from Austria, Italy, Finland, Spain, Germany, France and the United Kingdom recorded high level of efficiency score under both the CRS (DEA) and VRS (DEA) models. The results of our efficiency estimation also show that the European cooperative banking sector is both efficient and stable over the period being analysed. Our results lend credence to the resilience theory of the co-operative banking business model. During the period of the great financial crisis, the sector holds firm showing little or no variation in efficiency level.

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